

Lockheed Environmental Systems & Technologies Co.  
Lockheed Analytical Services  
975 Kelly Johnson Drive Las Vegas, Nevada 89119-3705  
Telephone 702-361-0220 800-582-7605 Facsimile 702-361-8146

LK 6090

0044203

LOCKHEED MARTIN

January 19, 1996

Ms. Joan Kessner  
Bechtel Hanford, Inc.  
P.O. Box 969  
1022 Lee Boulevard  
Richland, WA 99352

RE: Log-in No.: L6090  
Quotation No.: Q400000-B  
SAF: B96-047  
Document File No.: 1221596  
WHC Document File No.: 310  
SDG No.: LK6090



The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on December 21, 1995. The temperature of the cooler upon receipt was 2°C. Sample containers received agree with the chain-of-custody documentation. Sample containers were received intact. Samples designated for nitrate/nitrite and phosphate analysis by method 300.0 were not received in time to meet the analytical holding time requirements.

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Kathleen Hall at (509) 375-4741.



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***Lockheed Analytical Services***

Log-in No.: L6090  
Quotation No.: Q400000-B  
SAF: B96-047  
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SDG No.: LK6090

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

" I certify that this data package is in compliance with the SOW, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or a designee, as verified by the following signature."

Sincerely,

  
Kathleen M. Hall  
Client Services Representative

cc: Client Services  
Document Control

**CASE NARRATIVE  
INORGANIC NON METALS ANALYSES  
WATER**

The routine calibration and quality control analyses performed for this batch include as applicable: initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), matrix spike sample(s), and duplicate sample(s).

**Preparation and Analysis Requirements**

- One water sample was received for LK5106 and analyzed in batch 1221 bh for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following sample:

Client ID	LAL #		Method
BOGZ50	L6090-3	MS, DUP	300.0 Chloride, Nitrate-Nitrogen, Nitrite-Nitrogen, Orthophosphate, Sulfate
	L6090-6	MS, DUP	350.1 Ammonia
	L6090-4	MS, DUP	353.2 Nitrate-Nitrite-Nitrogen
	L6090-5	MS, DUP	9030 Sulfide

**Holding Time Requirements**

- All samples were analyzed within the method-specific holding times.

**Method Blanks**

- The concentration levels of all the requested analytes in the method blank were below the reporting detection limits.

**Internal Quality Control**

- All Internal Quality Control were within acceptance limits.

Kay McCann  
Prepared By

January 12, 1996  
Date

**CASE NARRATIVE  
INORGANIC METALS ANALYSES  
WATERS AND FILTERED WATER**

The routine calibration and quality control analyses performed for this batch include as applicable: instrument tune (ICP/MS only), initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), ICP interference check samples (ICP only), serial dilutions, analytical (post-digestion) spike samples, matrix spike (predigestion) sample(s), duplicate sample(s).

**Preparation and Analysis Requirements**

All samples were received on December 21, 1995. The samples were logged in as L6090 and were prepared and analyzed in batches 1221 bhT for total metals and 1221 bhD for dissolved metals.

**Holding Time Requirements**

- All samples were analyzed within the method-specific holding times.

**Method Blanks**

- The concentration levels of all the requested analytes in the method blank were below the reporting detection limits.

**Internal Quality Control**

- All Internal Quality Control were within acceptance limits.

Shellee McGrath  
Prepared By

January 18, 1996  
Date

## **CASE NARRATIVE RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, duplicate samples.

NOTE: Chemical recoveries and minimum detectable activities (MDAs) can be found on the preparation sheets and calculation sheets on the attached raw data for each method.

### **Holding Time Requirements**

All holding times were met.

### **Gas Proportional Counter**

#### *Analytical Method Gross Alpha/Beta*

The gross alpha/beta analysis was performed using standard operating procedure (SOP), LAL-91-SOP-0060. The samples were analyzed in workgroup 31926. The instrument calibration verification met criteria. The method blank was within QC criteria. The laboratory control sample (LCS) and matrix spike (MS) recoveries were within QC criteria. The duplicate (DUP) recoveries were within QC criteria. The MDA exceeded the reporting detection limit (RDL) due to the residue weight limitations forcing a volume reduction, the associated samples were flagged with a "C" qualifier. No re-analyses were performed.

#### *Analytical Method Total Strontium*

The total strontium analysis was performed using SOP, LAL-92-SOP-0196. The samples were analyzed in workgroup 31937. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The DUP recoveries were within QC criteria. The chemical recoveries were below QC criteria in the LCS, method blank, and sample BOGZ50 (L6090-7). Because there was no activity in the samples, and the samples were below the RDL data quality is not believed to be adversely affected. No re-analyses were performed.

***Lockheed Analytical Services***

Log-in No.: L6090  
Quotation No.: Q400000-B  
SAF: B96-047  
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WHC Document File No.: 310  
SDG No.: LK6090

**Liquid Scintillation Counter**

***Analytical Method Carbon-14***

The carbon-14 analysis was performed using SOP, LAL-93-SOP-0209. The samples were analyzed in workgroup 31920. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS and MS recoveries were within QC criteria. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No re-analyses were performed.

***Analytical Method Tritium***

The tritium analysis was performed using SOP, LAL-91-SOP-0066. The samples were analyzed in workgroup 31944. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS and MS recoveries were within QC criteria. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No re-analyses were performed.

Andrea Tippet  
Prepared By

January 16, 1996  
Date

**Lockheed Analytical Services**  
**DATA QUALIFIERS FOR INORGANIC ANALYSES**

[Revised 08/28/92]

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	<i>For CLP Analyses Only</i> -- Reported value is less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
<b>C</b>	<i>For Routine, Non-CLP Analyses Only</i> -- Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL).
<b>D</b>	Presence of high levels of interfering constituents required dilution of sample which increased the RDL by the dilution factor.
<b>E</b>	Estimated value due to presence of interference.
<b>H</b>	Sample analysis performed outside of method-or client-specified maximum holding time requirement.
<b>M</b>	<i>For CLP Analyses Only</i> -- Duplicate injection precision criterion was not met.
<b>N</b>	Matrix spike recovery exceeded acceptance limits.
<b>S</b>	Reported value was determined from the method of standard addition.
<b>U</b>	<i>For CLP Reporting Only</i> -- Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture).
<b>W</b>	<i>For AAS Only</i> -- Post-digestion spike for Furnace AAS did not meet acceptance criteria and sample absorbance is less than 50% of spike absorbance.
<b>X, Y, or Z</b>	Analyst-defined qualifier.
<b>*</b>	Relative percent difference (RPD) for duplicate analysis exceeded acceptance limits.
<b>+</b>	Correlation coefficient (r) for the MSA is less than 0.995.
<b>For Use on the QC Data Reporting Forms</b>	
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and matrix spike duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the RDL.

<sup>1</sup> Used as footnote designations on the QC summary form.

**Lockheed Analytical Services**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 08/28/92]*

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
<b>C</b>	Presence of high TDS in sample required reduction of sample size which increased the MDA.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only--</i> FWHM exceeded acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.



LOCKHEED ANALYTICAL SERVICES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Dec 21 1995, 01:52 pm

Login Number: L6090  
 Account: 596 Bechtel Hanford, Inc. \* Richland, WA  
 Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L6090-1 TEMP 2 Location: 157 Water 1 S SCREENING	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:16-JUN-96		
L6090-2 TEMP 2 Location: 157 Water 1 S 6010 ICP METALS	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:16-JUN-96		
L6090-3 TEMP 2 Location: 157 Water 1 S 300.0 CHLORIDE Water 1 S 300.0 NITRATE Water 1 S 300.0 NITRITE Water 1 S 300.0 PHOSPHATE Water 1 S 300.0 SULFATE	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:16-JAN-96		
		Hold:21-DEC-95		
		Hold:21-DEC-95		
		Hold:21-DEC-95		
		Hold:16-JAN-96		
L6090-4 TEMP 2 Location: 157 Water 1 S 353.2 NITRATE	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:16-JAN-96		
L6090-5 TEMP 2 Location: 157 Water 1 S 9030 SULFIDE	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:26-DEC-95		
L6090-6 TEMP 2 Location: 157 Water 1 S 350.1 NH3/N	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:16-JAN-96		
L6090-7 TEMP 2 Location: 157 Water 1 S GR ALP/BETA LAL-0060 Water 1 S SR-90 LAL-0196	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
		Hold:16-JUN-96		
		Hold:16-JUN-96		
L6090-8 TEMP 2 Location: 157	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96

LOCKHEED ANALYTICAL SERVICES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Dec 21 1995, 01:52 pm

Login Number: L6090  
 Account: 596 Bechtel Hanford, Inc. \* Richland, WA  
 Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L6090-9 TEMP 2 Location: 157	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
L6090-10 TEMP 2 Location: 157	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
L6090-11 TEMP 2 Location: 157	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
L6090-12 TEMP 2 Location: 157	BOGZ50	19-DEC-95	21-DEC-95	25-JAN-96
Water 1 S C-14 LAL-0209		Hold:16-JUN-96		
Water 1 S TRITIUM(H3) LAL-0066		Hold:16-JUN-96		
L6090-13 TEMP 2 Location: 157	BOGZ51	19-DEC-95	21-DEC-95	25-JAN-96
Filt H2O 15 S 6010 ICP METALS		Hold:16-JUN-96		
L6090-14 Location:	REPORT TYPE	21-DEC-95	21-DEC-95	25-JAN-96
Water 1 S EDD - DISK DEL.				
Water 1 S INORG TYPE 2 RPT +				
Water 1 S RAD RPT TYPE 2				

Signature: Paul Davis

Date: 12-21-95 0013

1221596

Bechtel Hanford, Inc.		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST <span style="font-size: 2em; float: right;">L6090</span>										Page <u>1</u> of <u>1</u>		
Collector <u>N. Rizzo B. Reinberg</u>				Company Contact Bob Raidl				Telephone (509) 372-9641				Data Turnaround <input type="checkbox"/> Priority <input checked="" type="checkbox"/> Normal		
Project Designation 100-HR-3 Groundwater Sampling, Round 10, Phase 1				Sampling Location 100 H				SAF No. B96-047						
Ice Chest No.				Field Logbook No. <u>SL 1018</u>				Method of Shipment Federal Express						
Shipped To Lockheed				Offsite Property No. <u>W910-0-0640-13</u>				Bill of Lading/Air Bill No. <u>2904648241</u>						
Possible Sample Hazards/Remarks				Preservation	HNO <sub>3</sub>	Cool 4°C	H <sub>2</sub> SO <sub>4</sub>	*1	H <sub>2</sub> SO <sub>4</sub>	HNO <sub>3</sub>	Cool 4°C	Cool 4°C		HNO <sub>3</sub>
				Type of Container	G	G	P/G	P	P/G	P/G	G	P/G		G
				No. of Container(s)	1	1	1	1	1	5	1	1		1
Special Handling and/or Storage Maintain samples between 2°C and 6°C.				Volume	500mL	500mL	500mL	1L	1L	1L	1L	20mL		500mL
SAMPLE ANALYSIS				ICP Metals (Unfiltered)	Anions (IC) - Cl, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , PO <sub>4</sub>	NO <sub>2</sub> - NO <sub>3</sub>	Sulfide	Ammonia	Gross Alpha, Gross Beta, Sr-90	Tritium, C-14	Activity Scan		ICP Metals (Filtered)	
Sample No.	Matrix*	Date Sampled	Time Sampled											
BOGZ50	W	12-19-95	1330	✓	✗	✗	✗	✗	✗	✗	✗			
BOGZ51	W	12-19-95	1330										✓	
CHAIN OF POSSESSION		Sign/Print Names				SPECIAL INSTRUCTIONS							Matrix* S = Soil SE = Sediment SO = Solid SL = Sludge W = Water O = Oil A = Air DS = Drum Solids DL = Drum Liquids T = Tissue WI = Wipe L = Liquid V = Vegetation X = Other	
Relinquished By		Date/Time 14:32		Received By		*1 ZnAc + NaOH								
<u>REDOO</u>		<u>12-19-95</u>		<u>Bob Raidl</u>		Sample analysis for phosphate, nitrate, and nitrite by EPA 300.0 is being requested for information only. The ERC Contractor acknowledges that the 48-hour holding time will not be met.								
Relinquished By		Date/Time 0900		Received By		The Activity Scan is for all samples listed on this chain of custody.								
<u>Bob Reinberg</u>		<u>12-20-95</u>		<u>Bob Reinberg</u>										
Relinquished By		Date/Time		Received By										
Relinquished By		Date/Time		Received By										
Relinquished By		Date/Time		Received By										
LABORATORY SECTION	Received By		Title		Date/Time									
	<u>Paula Dant</u>		<u>Sample Custodian</u>		<u>12-21-95/5:35A</u>									
FINAL SAMPLE DISPOSITION	Disposal Method		Disposed By		Date/Time									

## SAMPLE CHECK-IN LIST

Date/Time Received: 12-21-95/9:35am SDG#: 12114

Work Order Number: 11A SAF #: 1396-047

Shipping Container ID: ER-10 Chain of Custody #: 1112

1. Custody Seals on shipping container intact? Yes ☒ No ☐
2. Custody Seals dated and signed? Yes ☒ No ☐
3. Sample temperature 20
4. Vermiculite/packing materials is Wet ☐ Dry ☒
5. Each sample is in a plastic bag? Yes ☒ No ☐
6. Sample holding times exceeded? Yes ☒ No ☐ <sup>per 12-21-95</sup>

7. Samples have:

       tape        hazard labels  
  X   custody seals        appropriate sample labels

8. Samples are:

  X   in good condition        leaking  
       broken        have air bubbles

9. Is the information on the COC and Sample bottles in agreement?

Yes ☒

No ☐

Notes: \_\_\_\_\_

Sample Custodian/Laboratory: Paula Davis / L495 Date: 12-21-95

<sup>Faxen</sup>  
Telephoned To: Rothkenn Hall On 12-21-95 By Paula Davis

# LOCKHEED MARTIN

## Sample Login Login Review Checklist

Lot Number L 6090

The login review should be conducted by that person logging in the samples as well as a peer. Please use this checklist to ensure that such reviews occur in a uniform basis. Please sign and date below to verify that a login review has occurred. This checklist should be affixed to each login package prior to distribution.

For effective login review, at a minimum, five reports from the login process are required. These are the COC (or equivalent), the login COC report, the sample summary report, the sample receiving checklist, and the login quotation. Before beginning review, ensure that these five components are available. Jobs with single component samples, the sample summary report may be omitted.

### SAMPLE SUMMARY REPORT

YES NO N/A Comment

- |   |          |           |           |                             |
|---|----------|-----------|-----------|-----------------------------|
| 1. Are all sample ID's correct?                                       | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |
| 2. Are all samples present?   | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |
| 3. Are all matrices indicated correctly?                              | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |
| 4. Are all analyses on the COC logged in for the appropriate samples? | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |
| 5. Are all analyses logged in for the correct container?              | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |
| 6. Are samples logged in according to LAS batching procedures?        | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |

### LOGIN CHAIN OF CUSTODY

YES NO N/A Comment

- |   |          |           |           |                             |
|---|----------|-----------|-----------|-----------------------------|
| 1. Are the collect, receive, and due dates correct for every sample?    | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |
| 2. Have all appropriate comments been indicated in the comment section? | <u>X</u> | <u>  </u> | <u>  </u> | <u>                    </u> |

### SAMPLE RECEIVING CHECKLIST

YES NO N/A Comment

- |   |           |           |          |                             |
|---|-----------|-----------|----------|-----------------------------|
| 1. Are all discrepancies between the COC and the login noted (if applicable)? | <u>  </u> | <u>  </u> | <u>X</u> | <u>                    </u> |
|---|-----------|-----------|----------|-----------------------------|

Paul Dais  
primary review signature

12-21-85  
date

Paul Dais  
secondary review signature

12-21-85 0016  
date

1221596

Lockheed Analytical Services  
Sample Receiving Checklist

Page 1 of

Client Name: Boettel - Hanford

Job No. L6090

Cooler ID: 1.1.1

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: 22

temperature of temp. blank upon receipt:

	Yes	No	* Comments/Discrepancies
custody seals intact	X		
chain of custody present	X		
blue ice (or equiv.) present/frozen	X		
rad survey completed	X		

SAMPLE CONDITION UPON RECEIPT

	Yes	No	* Comments/Discrepancies
all bottles labeled	X		
samples intact	X		
proper container used for sample type	X		
sample volume sufficient for analysis	X		
proper pres. indicated on the COC	X		
VOA's contain headspace			
are samples bi-phasic (if so, indicate sample ID'S):			<u>17.1.1</u> <u>17.1.2</u>

MISCELLANEOUS ITEMS

	Yes	No	* Comments/Discrepancies
samples with short holding times	X		
samples to subcontract			<u>none. ref. alternates</u>

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: Paul Davis 12-21-95

Sent to the client (date/initials):

\*\* Client's signature upon receipt:

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702) 361-8146

1221596

0017

Lockheed Analytical Laboratory  
SAMPLE SUMMARY REPORT (su02)  
Bechtel Hanford, Inc. \* Richland, WA

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
BOGZ50	L6090-1		Water	SCREENING
	L6090-2		Water	6010 ICP METALS
	L6090-3		Water	300.0 CHLORIDE
	L6090-3		Water	300.0 NITRATE
	L6090-3		Water	300.0 NITRITE
	L6090-3		Water	300.0 PHOSPHATE
	L6090-3		Water	300.0 SULFATE
	L6090-4		Water	353.2 NITRATE
	L6090-5		Water	9030 SULFIDE
	L6090-6		Water	350.1 NH3/N
	L6090-7		Water	GR ALP/BETA LAL-
	L6090-7		Water	SR-90 LAL-0196
	L6090-12		Water	C-14 LAL-0209
L6090-12		Water	TRITIUM(H3) LAL-	
BOGZ51	L6090-13		Filt H2O	6010 ICP METALS
REPORT TYPE	L6090-14		Water	EDD - DISK DEL.
	L6090-14		Water	INORG TYPE 2 RPT
	L6090-14		Water	RAD RPT TYPE 2

0018

1221596

# LOCKHEED ANALYTICAL SERVICES

## Sample Results

Client Sample ID: B0GZ50	Date Collected: 19-DEC-95
Matrix: Water	Date Received: 21-DEC-95
Percent Solids: N/A	

Constituent	Units	Method	Result	Project Reporting Limit	Data Qualifier(s)	Date Analyzed	LAS Batch ID	LAS Sample ID
Chloride	mg/L	300.0	2.2	0.020		21-DEC-95	31784	L6090-3
Nitrate-N	mg/L	300.0	0.60	0.020		21-DEC-95	31781	L6090-3
Nitrite-N	mg/L	300.0	< 0.002	0.010	U	21-DEC-95	31782	L6090-3
Ortho Phosphate	mg/L	300.0	< 0.020	0.10	U	21-DEC-95	31783	L6090-3
Sulfate	mg/L	300.0	14.	0.10		21-DEC-95	31785	L6090-3
Ammonia Nitrogen	mg/L	350.1	< 0.040	0.050	U	10-JAN-96	31872	L6090-6
Nitrate-Nitrite-Nitrogen	mg/L	353.2	0.51	0.050		09-JAN-96	31874	L6090-4
Sulfide	mg/L	9030	< 1.0	3.0	U	23-DEC-95	31829	L6090-5



# LOCKHEED ANALYTICAL SERVICES

## Sample Results

Client Sample ID: B0GZ50	Date Collected: 19-DEC-95
Matrix: Water	Date Received: 21-DEC-95
Percent Solids: N/A	

Constituent	Units	Method	Result	IDL	RDL	Data Qual	Dilution	Date Analyzed	LAS Batch ID	LAS Sample ID
ALUMINUM, TOTAL	mg/L	6010	0.062	0.027	0.20	B	1	16-JAN-96	32131	L6090-2
ANTIMONY, TOTAL	mg/L	6010	< 0.055	0.055	0.060	U	1	11-JAN-96	32131	L6090-2
ARSENIC, TOTAL	mg/L	6010	< 0.078	0.078	0.20	U	1	11-JAN-96	32131	L6090-2
BARIUM, TOTAL	mg/L	6010	< 0.016	0.016	0.20	U	1	11-JAN-96	32131	L6090-2
BERYLLIUM, TOTAL	mg/L	6010	< 0.0010	0.0010	0.0050	U	1	11-JAN-96	32131	L6090-2
CADMIUM, TOTAL	mg/L	6010	< 0.0040	0.0040	0.0050	U	1	11-JAN-96	32131	L6090-2
CALCIUM, TOTAL	mg/L	6010	25.	0.013	5.0		1	11-JAN-96	32131	L6090-2
CHROMIUM, TOTAL	mg/L	6010	0.016	0.0030	0.010		1	11-JAN-96	32131	L6090-2
COBALT, TOTAL	mg/L	6010	< 0.0040	0.0040	0.050	U	1	11-JAN-96	32131	L6090-2
COPPER, TOTAL	mg/L	6010	0.030	0.0030	0.025		1	11-JAN-96	32131	L6090-2
IRON, TOTAL	mg/L	6010	0.084	0.0050	0.10	B	1	11-JAN-96	32131	L6090-2
LEAD, TOTAL	mg/L	6010	< 0.074	0.074	0.10	U	1	11-JAN-96	32131	L6090-2
MAGNESIUM, TOTAL	mg/L	6010	9.1	0.041	5.0		1	11-JAN-96	32131	L6090-2
MANGANESE, TOTAL	mg/L	6010	0.0031	0.0010	0.015	B	1	11-JAN-96	32131	L6090-2
NICKEL, TOTAL	mg/L	6010	< 0.014	0.014	0.040	U	1	11-JAN-96	32131	L6090-2
POTASSIUM, TOTAL	mg/L	6010	4.6	0.40	5.0	B	1	11-JAN-96	32131	L6090-2
SELENIUM, TOTAL	mg/L	6010	< 0.096	0.096	0.30	U	1	11-JAN-96	32131	L6090-2
SILVER, TOTAL	mg/L	6010	0.0032	0.0030	0.010	B	1	11-JAN-96	32131	L6090-2
SODIUM, TOTAL	mg/L	6010	10.	0.040	5.0		1	11-JAN-96	32131	L6090-2
THALLIUM, TOTAL	mg/L	6010	< 0.073	0.073	0.50	U	1	11-JAN-96	32131	L6090-2
VANADIUM, TOTAL	mg/L	6010	0.041	0.0040	0.050	B	1	11-JAN-96	32131	L6090-2
ZINC, TOTAL	mg/L	6010	0.075	0.0030	0.020		1	11-JAN-96	32131	L6090-2

# LOCKHEED ANALYTICAL SERVICES

## Sample Results

Client Sample ID: B0GZ51	Date Collected: 19-DEC-95
Matrix: Filt H2O	Date Received: 21-DEC-95
Percent Solids: N/A	

Constituent	Units	Method	Result	IDL	RDL	Data Qual	Dilution	Date Analyzed	LAS Batch ID	LAS Sample ID
ALUMINUM, DISSOLVED	mg/L	6010	< 0.027	0.027	0.20	U	1	11-JAN-96	32132	L6090-13
ANTIMONY, DISSOLVED	mg/L	6010	< 0.055	0.055	0.060	U	1	11-JAN-96	32132	L6090-13
ARSENIC, DISSOLVED	mg/L	6010	< 0.078	0.078	0.20	U	1	11-JAN-96	32132	L6090-13
BARIUM, DISSOLVED	mg/L	6010	< 0.016	0.016	0.20	U	1	11-JAN-96	32132	L6090-13
BERYLLIUM, DISSOLVED	mg/L	6010	< 0.0010	0.0010	0.0050	U	1	11-JAN-96	32132	L6090-13
CADMIUM, DISSOLVED	mg/L	6010	< 0.0040	0.0040	0.0050	U	1	11-JAN-96	32132	L6090-13
CALCIUM, DISSOLVED	mg/L	6010	28.	0.013	5.0		1	11-JAN-96	32132	L6090-13
CHROMIUM, DISSOLVED	mg/L	6010	0.0092	0.0030	0.010	B	1	11-JAN-96	32132	L6090-13
COBALT, DISSOLVED	mg/L	6010	< 0.0040	0.0040	0.050	U	1	11-JAN-96	32132	L6090-13
COPPER, DISSOLVED	mg/L	6010	< 0.0030	0.0030	0.025	U	1	11-JAN-96	32132	L6090-13
IRON, DISSOLVED	mg/L	6010	< 0.0050	0.0050	0.10	U	1	11-JAN-96	32132	L6090-13
LEAD, DISSOLVED	mg/L	6010	< 0.074	0.074	0.10	U	1	11-JAN-96	32132	L6090-13
MAGNESIUM, DISSOLVED	mg/L	6010	9.9	0.041	5.0		1	11-JAN-96	32132	L6090-13
MANGANESE, DISSOLVED	mg/L	6010	0.0023	0.0010	0.015	B	1	11-JAN-96	32132	L6090-13
NICKEL, DISSOLVED	mg/L	6010	< 0.014	0.014	0.040	U	1	11-JAN-96	32132	L6090-13
POTASSIUM, DISSOLVED	mg/L	6010	4.9	0.40	5.0	B	1	11-JAN-96	32132	L6090-13
SELENIUM, DISSOLVED	mg/L	6010	< 0.096	0.096	0.30	U	1	11-JAN-96	32132	L6090-13
SILVER, DISSOLVED	mg/L	6010	< 0.0030	0.0030	0.010	U	1	11-JAN-96	32132	L6090-13
SODIUM, DISSOLVED	mg/L	6010	11.	0.040	5.0		1	11-JAN-96	32132	L6090-13
THALLIUM, DISSOLVED	mg/L	6010	0.10	0.073	0.50	B	1	11-JAN-96	32132	L6090-13
VANADIUM, DISSOLVED	mg/L	6010	0.043	0.0040	0.050	B	1	11-JAN-96	32132	L6090-13
ZINC, DISSOLVED	mg/L	6010	< 0.0030	0.0030	0.020	U	1	11-JAN-96	32132	L6090-13

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. \* Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0GZ50

LAL Sample ID: L6090-7

Date Collected: 19-DEC-95

Date Received: 21-DEC-95

Matrix: Water

Login Number: L6090

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	08-JAN-96	GR ALP/BETA LAL-0060_31926	-0.18	0.90	2.0	C	pCi/L
Gross Beta	08-JAN-96	GR ALP/BETA LAL-0060_31926	3.4	1.5	2.2		pCi/L
Total radio-strontium	10-JAN-96	SR-90 LAL-0196_31937	-0.72	0.86	1.6		pCi/L

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. \* Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0GZ50

LAL Sample ID: L6090-12

Date Collected: 19-DEC-95

Date Received: 21-DEC-95

Matrix: Water

Login Number: L6090

Constituent	Analyzed	Batch	Activity	Error	MDA	Data Qual	Units
C-14	29-DEC-95	C-14 LAL-0209_31920	10.	72.	92.		pCi/L
H-3	08-JAN-96	TRITIUM(H3) LAL-0066_31944	20	220	270		pCi/L

SECONDARY/WORKING LEVEL  
STANDARD DILUTION RECORD

## Dilution Source Information

Isotope: Am-241 and Sr-90

Parent Barcode Number: AA0030 AA0046  
Am-241 IPK 388-100-1

Vendor or Certificate I.D. # of Parent Standard: Sr-90 NIST SRM 4919G  
Am-241 91-0225-60-1

Diluted Source Logbook I.D. #: Sr-90 91-0225-30-2

Balance Verification?: Yes

Diluent Used: 0.1N HNO<sub>3</sub>

## Dilution

\*Diluent: 0.1N HNO<sub>3</sub> + 42mg Sr(NO<sub>3</sub>)<sub>2</sub>/mL

\*Density of diluent (g/mL): NA

a: Parent Specific Activity: Am-241 981 pCi/mL  
Sr-90 6000 pCi/mL m 8/1/90

b: Amount of Source Transferred: Am-241 0.5 mL  
Sr-90 0.5 mL

c: Total amount of Dilution: 500 mL

d: Total Volume of Dilution: 500 mL

e: Activity of Dilution (a \* b / c): NA  
Am-241 9.81 pCi/mL

f: Activity of Dilution (a \* b / d): Sr-90 12 pCi/mL m 8/1/90

Dilution Logbook I.D. #: 95-721-13-1

Prepared By: Joe HutchinsonPreparation Date: 8/23/95Reviewed By: 97 Ar MordReview Date: 8/24/95

\*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Read and Understood By

0063

Signed

Date

Signed

Date

71-0225-64-1

# CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Radionuclide	Am-241	Customer:	LOCKHEED ENGINEERING & SCIENCES Co.	
Half Life:	432.7 $\pm$ 0.5 years	P.O.No.:	06LAB1245	
Catalog No.:	7241	Reference Date:	November 1 1991	12:00 PST.
Source No.:	388-100-1	Contained Radioactivity:	0.997	$\mu$ Ci.
<b>Description of Solution</b>				
a. Mass of solution:	5.0007			grams.
b. Chemical form:	AmCl <sub>3</sub> in 0.5N HCl			
c. Carrier content:	None added			
d. Density:	1.0077			gram/ml @ 20°C.
<b>Radioimpurities</b>				
	None detected			
<b>Radioactive Daughters</b>				
	None detected			
<b>Radionuclide Concentration</b>				
	0.1994			$\mu$ Ci/gram.

#### Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

#### Uncertainty of Measurement

- |  |             |
|--|-------------|
| a. Systematic uncertainty in instrument calibration: | $\pm 2.0\%$ |
| b. Random uncertainty in assay:                      | $\pm 0.7\%$ |
| c. Random uncertainty in weighing(s):                | $\pm 0.0\%$ |
| d. Total uncertainty at the 99% confidence level:    | $\pm 2.7\%$ |

#### NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

#### Notes

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)



ISOTOPE PRODUCTS LABORATORIES  
1800 No. Keystone Street.,  
Burbank, California 91504  
(818) 843 - 7000

*Ray A. Moore*  
QUALITY CONTROL



THIS IS A PHOTOCOPY OF THE CERTIFICATE  
WHICH IS BEING MAILED TO YOU UNDER  
SEPARATE COVER.

## National Institute of Standards & Technology

### Certificate

#### Standard Reference Material 4919-G Radioactivity Standard

Radionuclide	Strontium-90
Source identification	4919-G
Source description	Solution in NIST borosilicate-glass ampoule <sup>(1)*</sup>
Solution composition	Strontium-90 plus yttrium-90 plus approximately 95 $\mu\text{g}$ each of non-radioactive strontium and yttrium per gram of 1-molar hydrochloric acid <sup>(2)</sup>
Mass	Approximately 5.0 grams
Radioactivity concentration	$4.514 \times 10^3 \text{ Bq g}^{-1}$
Reference time	1200 EST August 1, 1990
Overall uncertainty	1.05 percent <sup>(3)</sup>
Photon-emitting impurities	None observed <sup>(4)</sup>
Alpha-particle-emitting impurities	None observed <sup>(5)</sup>
Half life	$28.5 \pm 0.2 \text{ years}$ <sup>(6)</sup>
Measuring instrument	$4\pi\beta$ liquid-scintillation counter

This standard reference material was prepared in the Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899  
January, 1991

William P. Reed, Acting Chief  
Office of Standard Reference Materials

\*Notes on back

0066

# CERTIFICATE OF CALIBRATION

## ALPHA STANDARD SOLUTION

Radionuclide	Am-241	Customer:	LOCKHEED ENGINEERING & SCIENCES Co.	
Half Life:	432.7 $\pm$ 0.5 years	P.O.No.:	06LAB1245	
Catalog No.:	7241	Reference Date:	November 1 1991	12:00 PST.
Source No.:	388-100-1	Contained Radioactivity:	0.997	$\mu$ Cl.

### Description of Solution

a. Mass of solution:	5.0007	grams.
b. Chemical form:	AmCl <sub>3</sub> in 0.5N HCl	
c. Carrier content:	None added	
d. Density:	1.0077	gram/ml @ 20°C.

### Radioimpurities

None detected

### Radioactive Daughters

None detected

### Radionuclide Concentration

0.1994  $\mu$ Cl/gram.

### Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

### Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:	$\pm 2.0\%$
b. Random uncertainty in assay:	$\pm 0.7\%$
c. Random uncertainty in weighing(s):	$\pm 0.0\%$
d. Total uncertainty at the 99% confidence level:	$\pm 2.7\%$

### NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

### Notes

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)



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Burbank, California 91504  
(818) 843 - 7000

*Ray A. Gilmore*  
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0068



# CERTIFICATE OF CALIBRATION

## BETA STANDARD SOLUTION

Radionuclide	Sr-90	Customer: LOCKHEED ENGINEERING & SCIENCES Co.
Half Life:	28.5 $\pm$ 0.2 years	P.O.No.: 06LAB1245
Catalog No.:	7090	Reference Date: November 1 1991 12:00 PST.
Source No.:	388-99-2	Contained Radioactivity: 1.018 $\mu$ Ci.

### Description of Solution

a. Mass of solution:	5.0012	
b. Chemical form:	SrCl <sub>2</sub> in 0.1N HCl	grams.
c. Carrier content:	None added	
d. Density:	0.9996	gram/ml @ 20°C.

### Radioimpurities

None (Y-90 daughter in equilibrium)

### Radioactive Daughters

Y-90 daughter in equilibrium

### Radionuclide Concentration

0.203  $\mu$ Ci/gram.

### Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

### Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:	± 1.5%
b. Random uncertainty in assay:	± 0.5%
c. Random uncertainty in weighing(s):	± 0.0%
d. Total uncertainty at the 99% confidence level:	± 2.0%

### NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

### Notes

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)



**ISOTOPE PRODUCTS LABORATORIES**

1800 No. Keystone Street.,

Burbank, California: 91504

(818) 843-7000

*Mary A. Silmore*  
**QUALITY CONTROL**

0069

# SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	(432.7yr) <u>Am-241</u> ; (29.1yr) <u>Sr/Y 90</u> <u>MS</u>
Parent <sup>Logbook</sup> <del>Barcode</del> Number	<u>92-353-81-1</u> ; <u>94-0677-92-1</u>
Vendor or Certificate I.D. # of Parent Standard:	_____
Diluted Source Logbook I.D. #:	<u>See ABOVE</u>
Balance Verification?:	<u>Yes</u>
Diluent Used:	<u>1 M HNO3</u>

Dilution	
*Diluent:	<u>1 M HNO3 + 10ml Sr Carrier (10mg/ml)</u>
*Density of diluent (g/ml):	<u>1.0290</u> g/ml
a: Parent Specific Activity:	<u>Am-241</u> <u>Sr/Y-90</u> * <u>1002.4</u> ; <u>1000.2</u> pCi/g @ 1/5/96
b: Amount of Source Transferred:	<u>4.070</u> ; <u>4.065</u> g
c: Total amount of Dilution:	<u>500.01</u> g
d: Total Volume of Dilution:	<u>514.5</u> ml
e: Activity of Dilution (a * b / c):	<u>Am-241</u> <u>Sr/Y-90</u> <u>8.16</u> <u>8.13</u> pCi/g @ 1/5/96
f: Activity of Dilution (a * b / d):	<u>8.40</u> <u>8.37</u> pCi/ml
Dilution Logbook I.D. #:	<u>94-0677-93-1</u>
* Sr/Y-90 in equilibrium. Activity reported = known Sr 90 activity * 2.	
Prepared By: <u>Q. C. Moul</u>	Preparation Date: <u>1/5/96</u>
Reviewed By: <u>Joe Hutchinson</u>	Review Date: <u>1/5/96</u>
*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.	

Read and Understood By

0070

Signed

Date

Signed

Date

# INITIAL STANDARD DILUTION RECORD

## Standard Information:

Isotope:	<u>Sr-90</u>	Vendor:	<u>IPL</u>
Activity of Standard Received:	<u>1.018</u> <u>5-0012</u> uCi	Vendor I.D. #	<u>—</u>
Weight of Standard Received (g):	<u>5.0012</u> g	LAL I.D. #:	<u>AA0049</u>
Standard Activity (pCi/g):	<u>2.036E5</u> pCi/g	NIST Traceable ?	<u>Yes</u>
Half-life in Years or Days:	<u>29.1</u> yrs	Certificate #:	<u>388-99-2</u>
Reference Date:	<u>11/1/91</u>	Receiver's Name:	<u>FREE</u>
		Date Received:	<u>12/91</u>

## Primary Dilution

Balance Verification?:	<u>Yes</u>
Diluent Used:	<u>1 M HNO<sub>3</sub> (1.0290 g/mL)</u>
a: Decay Corrected Standard Activity (pCi/g):	<u>1.844 E5</u> pCi/g @ <u>1/5/96</u>
b: Weight of the Source Transferred (g):	<u>4.949</u> g
c: Total diluted weight (g):	<u>100.01</u> g
d: Total Diluted Volume (mL)	<u>97.19</u> mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	<u>9125.0</u> pCi/g @ <u>1/5/96</u>
f: Calculated Density of Solution (g/mL) [c / d]:	<u>9389.8</u> g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	<u>9389.8</u> pCi/mL
h. Dilution Logbook I.D. #:	<u>94-0677-91-1</u>
Prepared By: <u>A. J. C. Moul</u>	Preparation Date: <u>1/5/96</u>
Reviewed By: <u>Joe Hitchman</u>	Review Date: <u>1/5/96</u>
Purity/Cross Check Performed By: _____	Check Date: _____

0071

Signed

Date

Signed

Date

# SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

## Dilution Source Information

Isotope: Sr-90

Parent Barcode Number: AA0049

Vendor or Certificate I.D. # of Parent Standard: ~~04-0677-91-1~~ 388-99-2

Diluted Source Logbook I.D. #: 94-0677-91-1

Balance Verification?: Yes

Diluent Used: 1.0 M HNO<sub>3</sub>

## Dilution

\*Diluent: 1.0 M HNO<sub>3</sub>

\*Density of diluent (g/ml): 1.0290 g/ml

a: Parent Specific Activity: 9125.0 pCi/g c. 1/5/96

b: Amount of Source Transferred: 6.012 g

c: Total amount of Dilution: 109.70 g

d: Total Volume of Dilution: 106.61 ml

e: Activity of Dilution (a \* b / c): 500.09 pCi/g 1/5/96

f: Activity of Dilution (a \* b / d): 514.6 pCi/ml

Dilution Logbook I.D. #: 94-0677-92-1

Prepared By: 4-j C. M. L.Preparation Date: 1/5/96Reviewed By: Joe HutchinsonReview Date: 1/5/96

\*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Read and Understood By

0072

Signed

Date

Signed

Date

## ISOTOPE DILUTION RECORD

Isotope: Am-241

Secondary/Working Level Dilution

Date: 4-9-93 Preparer's Name: A. Wong

Pipet Check / Balance Wt. Check Done (✓)

Diluted Source ID (log#): 91-225-60-1Diluent used: 0.5 N HClA: Source activity: 21700 dpm/g (9774.8 pCi/g)B: Amount of source transferred: 10.3235 gC: Total amount of dilution: 100.1029 gD: Activity of dilution (A\*B/C): 2237.90 dpm/gE: Density of Diluent: 1.0010 g/ml\* F: Activity by volume (D\*E): 2240.14 dpm/mlDilution Log Book ID: 92-335<sup>RW</sup> 92-353-81-1Reviewed by: [Signature] Date: 4/9/931.6" diameter filter LCS for Gamma Spec. 955 5/18/93  
(14 Petri dish and sealed)Prepared by Nee Van Nuyen 5/10/93 — Cut Whatman Glass Micro-  
fibre filter paper (originally 3" dia.) to 1.6" dia. — P. petted on filter.

Cs-137 1A-0199- 0.200 ul \* 975.18 pCi/ul = 195.0 pCi (≡ 197.8 pCi 4-2-91)

Cs-137 1A-0225-89-1 0.200 ul \* 110.36 pCi/ul = 22.07 pCi (≡ 259.1 pCi 4-2-91)

Continued on Page

N/A

(same pipette amounts as p. 80R)

Read and Understood By

Agnie Wong

Signed

4-9-93

Date

Jan M. Schmitt

Signed

5-18-93

Date

0074

4C5781  
R/S

U.S. Environmental Protection Agency  
Environmental Monitoring Systems Laboratory-Las Vegas  
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide **Strontium-90** Half-life **28.6 years**  
Nominal activity **27** **nano curies**  
Nominal volume **5** ml in ampoule/bottle number **94003-1**

Measurement Activity of principal radionuclide

Activity per gram of this solution

**5.40** **nano curies** of **Strontium-90**  
at 0400 hours PST on **April 1, 1994**

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

**5.40** **nano curies** Per gram

of the daughter nuclide **Yttrium-90**

Total mass of this solution

**Approximately 5.0 grams**

Method of measurement

The activity of the primary solution was measured by liquid scintillation counting.

The activity of the dilution was measured by liquid scintillation counting.

Useful Life

This radionuclide has decayed through **0.0** half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

**August 1994**

This dilution was prepared for the 1994 ASTM Collaborative Study of a test method for the determination of Sr-90 in water.

.0081

C57C3C

**Purity**

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

(1) <input type="text"/>	less than equal to	<input type="text"/> %	of the principal activity
(2) <input type="text"/>	less than equal to	<input type="text"/> %	of the principal activity
(3) <input type="text"/>	less than equal to	<input type="text"/> %	of the principal activity

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

**Random Errors**

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than  $\pm 0.1\%$  (The 99.7% confidence limits are given by  $t(sm)$  where  $t$  is obtained from the student  $t$  factor for the degree of freedom ( $n-1$ )).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ( $+\delta - \delta'$ ). These have been estimated not to exceed

$+3.8\%$  or  $-3.8\%$

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error  $[t(sm)]$  at the 99.7% confidence limits and the worst case estimate of the systematic errors ( $+\delta, -\delta'$ )

The overall uncertainty is therefore calculated on the basis of  $+ [t(sm) + \delta], - [t(sm) + \delta']$  and is  $+4.0\%, -4.0\%$  of the quoted radioactive concentration.

**Decay Schemes**

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Strontium-90 decays 100 percent by beta emission to yttrium-90. Yttrium-90 also decays 100 percent by beta emission.

**Chemical  
Composition  
of Solution**

Carrier content per gram of solution:  
30 micrograms strontium

Other components:

0.1 M HCl

Preservative:

**Remarks**

Date Certificate Prepared

April 26, 1994

Approval Signature

*Paul B. Fahn* 0082

## INITIAL STANDARD DILUTION RECORD

## Standard Information:

Isotope:

Sr-90

Vendor:

EPA

Activity of Standard Received:

 $2.7 \times 10^4$  uCi

Vendor I.D. #

94003-1

Weight of Standard Received (g):

50 g

LAL I.D. #:

AC5281

Standard Activity (pCi/g):

 $5.4 \times 10^3$  pCi/g

NIST Traceable ?

yes

Half-life in Years or Days:

28.6 yrs

Certificate #:

94003-1

Reference Date:

4-1-1994

Receiver's Name:

K. Free

Date Received:

5-3-94

## Primary Dilution

Balance Verification?:

yes

Diluent Used:

0.1M HCl

a: Decay Corrected Standard Activity (pCi/g):

 $5.4 \times 10^3$  pCi/g

b: Weight of the Source Transferred (g):

4.9670 g

c: Total diluted weight (g):

49.91 g

d: Total Diluted Volume (mL)

50 mL

e: Activity of Dilution by Weight (pCi/g) [a \* b / c]:

537.4 pCi/g

f: Calculated Density of Solution (g/mL) [c / d]:

0.9982 g/mL

g: Activity of Dilution by Volume (pCi/mL) [e \* f]:

536.44 pCi/mL

h. Dilution Logbook I.D. #:

93-474-81-1 <sup>93-474-82-1</sup> <sub>CP 4/1/95</sub>

Prepared By:

Igneas Wong

Preparation Date:

6-15-94

Reviewed By:

Joe Hutchison

Review Date:

6/30/94

Purity/Cross Check Performed By:

Check Date:

Signed

Date

Signed

Date

0083



SECONDARY/WORKING LEVEL  
STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	<u>Sr-90</u>
Ref. <u>4-1-94</u>	
Parent Barcode Number	<u>AC5281</u>
Vendor or Certificate I.D. # of Parent Standard:	<u>EPA 94003 - 1</u>
Diluted Source Logbook I.D. #:	<u>93-474 -82-1</u>
Balance Verification?:	<u>Yes</u>
Diluent Used:	<u>0.1 M HCl</u>

Dilution	
*Diluent:	<u>0.1 M HCl</u>
*Density of diluent (g/ml):	<u>N/A</u>
a: Parent Specific Activity:	<u>536.44 pCi/ml</u>
b: Amount of Source Transferred:	<u>5.0018</u> g
c: Total amount of Dilution:	<u>100.20</u> g
d: Total Volume of Dilution:	<u>N/A</u>
e: Activity of Dilution (a * b / c):	<u>N/A</u>
f: Activity of Dilution (a * b / d):	<u>26.78 pCi/ml</u>
Dilution Logbook I.D. #:	<u>94-677-44 - 1</u>
Prepared By: <u>Dynes Wong</u>	Preparation Date: <u>3-2-95</u>
Reviewed By: <u>Joe H. H.</u>	Review Date: <u>3/3/95</u>

\*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Signed

Date

Signed

Date

Dynes Wong 3-3-95 0084

**Strontium Carrier Standardization****Strontium Carrier (10 mg/mL):**

Use commercially available 10,000  $\mu\text{g}$  Sr/mL ICP Standard or equivalent. Alternately, Dissolve 24.16 g of  $\text{Sr}(\text{NO}_3)_2$  in water and dilute to 1 L in a volumetric flask with water.

Perform calibration check on a 0.5 mL pipet and then carefully pipet 3 - 0.5 mL portions of the strontium carrier solution into separate cleaned dried and tared planchets. Dry the planchet under a drying lamp. Cool the planchets in a desiccator and weigh.

	Calib # 1	Calib # 2	Calib # 3
Carrier plus planchet wt. (mg)	6865.84	6562.93	6540.56
Tare wt. of planchet (mg)	6853.57	<del>68</del> 6550.76	6528.26 <del>6520</del>
Net wt. of carrier added (mg)	12.27	12.17	12.30

AVERAGE  $\text{Sr}(\text{NO}_3)_2 \pm \text{STD DEV.} = 12.25 \pm 0.0681$   $\left(0.01225\text{g} \pm 0.0001\text{g} \text{ per } 0.5\text{mL}\right)$

Expected mg of  $\text{Sr}(\text{NO}_3)_2 = \text{cert. value} (=10\text{mg of Sr/mL}) * 0.5 \text{ mL} * 2.41$

Within 3% of expected (12.08 mg/0.5 mL) value (yes/no) yes

Initial and Date: WL 10-5-95

# 94-658-20

Walter Lutz 10-11-95

Continued on Page \_\_\_\_\_

Read and Understood By

WL  
Signed

10-4-95  
Date

Theresa Wong  
Signed

1-16-96 085  
Date

**SPEX**

# CERTIFICATE OF ANALYSIS

Catalog Number: PLSR2-3X Lot No. G3-153SR  
Element and Matrix: Sr/HNO<sub>3</sub>/H<sub>2</sub>O  
Starting Material: Strontium Carbonate SrCO<sub>3</sub>  
Starting Material Lot Number: 05941D

Trace Metallic Impurities in the actual solution via ICP of the concentrate.

Element	PPM	Element	PPM	Element	PPM
Ag	<.05	Cu	<.05	P	<.05
Al	<.05	Fe	<.05	Pb	.06
As	<.05	Ga	<.05	Sb	<.10
B	<.05	In	<.05	Si	<.05
Ba	<.05	K	<.05	Sn	<.10
Be	<.05	Li	<.05	Ti	<.05
Bi	<.05	Mg	<.05	Tl	<.05
Ca	<.05	Mn	<.05	V	<.05
Cd	<.05	Mo	<.10	Zn	<.05
Co	<.05	Na	<.05	Zr	<.10
Cr	<.05	Ni	<.05		

## Traceability Documentation For Solution Standard:

1. Classical Wet Assay: 10,050 ppm.

Titrimetry: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against NIST Pb(NO<sub>3</sub>)<sub>2</sub> SRM 928.

2. Instrumentation Analysis By Inductively Coupled Plasma Spectrometer[ICP]: 10,009 ppm via NIST SRM 3153a.
3. Balances are calibrated with NIST weight sets N.J. #92589 and #92550, according to NIST circular 547 3.4.3.

SPEX plasma solution standards are guaranteed stable and accurate to  $\pm 0.5\%$  of labeled concentration for one year from date of shipment. This value is the sum of cumulative errors associated with analytical determinations, pipetting and diluting to final volume. For these solutions we use high purity acids, 18 megohm double deionized water and triple rinsed bottles. All glassware used is class A.

Signed by:

*N. Kocherakota*

Chemical Production Manager,

Date:

SEP 95

**SPEX**

Printed on Recycled Paper

# CERTIFICATE OF CALIBRATION BETA STANDARD SOLUTION

AA0114

Radionuclide C-14  
Half Life: 5730  $\pm$  40 years  
Catalog No.: 7014  
Source No.: 407-124-2

Customer: LOCKHEED ENVIRONMENTAL  
P.O.No.: 06LAB2959  
Reference Date: November 15 1992 12:00 PST.  
Contained Radioactivity: 1.093  $\mu$ Ci  
Contained Radioactivity: 40.4 kBq

## Description of Solution

a. Mass of solution: 5.0242 grams  
b. Chemical form: Benzoic Acid Carboxy-C-14 in 0.1N NaOH  
c. Carrier content: None added  
d. Density: 1.002 g/ml @ 20°C.

## Radioimpurities

None detected

## Radioactive Daughters

None

## Radionuclide Concentration

0.218  $\mu$ Ci/g.

## Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

## Uncertainty of Measurement

- |  |             |
|--|-------------|
| a. Systematic uncertainty in instrument calibration: | $\pm 1.8\%$ |
| b. Random uncertainty in assay:                      | $\pm 0.5\%$ |
| c. Random uncertainty in weighing(s):                | $\pm 1.0\%$ |
| d. Total uncertainty at the 99% confidence level:    | $\pm 2.2\%$ |

## NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

## Notes

1. Nuclear data were taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).



**ISOTOPE PRODUCTS LABORATORIES**  
1800 North Keystone Street  
Burbank, California 91504  
(818) 843 - 7000

*Allen H. Allen*  
**QUALITY CONTROL**

*Nov. 17, 1992*

**Date Signed**

0095

AA0114

## ISOTOPE WEIGHT DILUTION RECORD

Isotope: C-14 Vendor: IPL  
Total Received Activity: 1.093  $\mu$ Ci Vendor ID: 407-124-2  
Wt. Received: 5.024 g NIST Traceable (Y) Cert. # Implicitly  
Activity in Units/g: .2175  $\mu$ Ci/g Reference Date: 11-15-92  
Activity converted (dpm/g): 482,954 dpm/g Receive Date: 11/18/92  
Half-life (Yrs or days)  $t_{1/2}$  = 5730  $\pm$  40 years Receiver's Name: Jimmy McInnes

## PRIMARY DILUTION:

Balance wt. check done ☒

a: Source activity: 482,954 dpm/g \* (if  $t_{1/2}$  = < 100yr decay to prep. date)  
b: Wt. of Source transferred: 4.90951 g  
Diluent used: 0.1 N. OH  
c: Total diluted weight: 116.53 g  
d: Activity of dilution (a\*b/c): 20,347 dpm/g  $\pm 2.2\%$   
e: Calculated density of solution: 1.002 g/mL (4M HNO<sub>3</sub> = 1.1294  $\pm$  .0007 g/mL)  
f: Activity by volume = (d\*e): 20,388 dpm/mL  
Dilution Log Book ID: LA2-93-474-23-1 ✓  
Preparation Date: 10/27/93 Preparer's Name: MY

## SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done ☒

Log Book ID of source being diluted: \_\_\_\_\_  
a: Source activity: \_\_\_\_\_ dpm/g \* (if  $t_{1/2}$  = < 100yr decay to prep. date)  
b: Wt. of Source transferred: \_\_\_\_\_ g  
Diluent used: \_\_\_\_\_  
c: Total diluted weight: N/A g  
d: Activity of dilution (a\*b/c): \_\_\_\_\_ dpm/g  
e: Calculated density of solution: \_\_\_\_\_ g/mL (4M HNO<sub>3</sub> = 1.1294  $\pm$  .0007 g/mL)  
f: Activity by volume = (d\*e): \_\_\_\_\_ dpm/mL  
Dilution Log Book ID: \_\_\_\_\_

ras  
Signed10/27/93  
Date

Revised Signed

0096

Date

# INITIAL STANDARD DILUTION RECORD

Standard Information:			
Isotope:	<b>C-14</b>	Vendor:	Isotope Product
Activity of Standard Received:	1.09 uCi	Vendor I.D. #	
Weight of Standard Received (g):	5.0242 g	LAL I.D. #:	<b>AA0114</b>
Standard Activity (pCi/g):	2.17E+05 pCi/g	NIST Traceable ?	Yes
Half-life in Years or Days:	5730 yrs	Certificate #:	407-124-2
Reference Date:	11/15/92	Preparer's Name:	Mark Young
		Date Received:	11/18/92

Primary Dilution:	
Balance Verification?:	Yes
Diluent Used:	0.1 N NaOH
a: Decay Corrected Standard Activity (pCi/g):	2.17E+05 pCi/g
b: Weight of the Source Transferred (g):	4.90951 g
c: Total diluted weight (g):	116.53 g
d: Total Diluted Volume (mL)	116.3 mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	9.139E+03 pCi/g
f: Calculated Density of Solution (g/mL) [c / d]:	1.0020 g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	9.157E+03 pCi/mL
h. Dilution Logbook I.D. #:	<b>LAL-93-0474-23-1</b>
Prepared By: _____	Preparation Date: <b>10/27/93</b>
Reviewed By: _____	Review Date: _____
Purity/Cross Check Performed By: _____	Check Date: _____

0097

# SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	C-14
Parent Barcode Number	AA0114
Vendor or Certificate I.D. # of Parent Standard:	407-124-2
Diluted Source Logbook I.D. #:	LAL-93-0474-23-1
Balance Verification?:	Yes
Diluent Used:	0.1 N NaOH

Dilution	
*Diluent:	Nanopure w/ 1 mg/ml formaldehyde
*Density of diluent (g/ml):	1.0006 g/ml
a: Parent Specific Activity:	9.14E+03 pCi/g
b: Amount of Source Transferred:	0.70 g
c: Total amount of Dilution:	250.14 g
d: Total Volume of Dilution:	250 ml
e: Activity of Dilution [a * b / c]:	2.57E+01 pCi/g
f: Activity of Dilution (a * b / d):	2.58E+01 pCi/ml
Dilution Logbook I.D. #:	LAL-94-0677-18-1
Prepared By: <u>Agnes Wong</u>	Preparation Date: <u>11/19/94</u>
Preparer Signature: _____	
Reviewed By: _____	Review Date: _____
Reviewer Signature: _____	
*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.	

AA0114

## SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

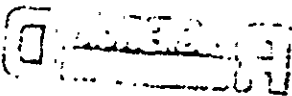
Dilution Source Information	
Isotope:	<u>C-14</u>
Parent Barcode Number	<u>AA0114</u>
Vendor or Certificate I.D. # of Parent Standard:	<u>93-474-23-1</u>
Diluted Source Logbook I.D. #:	<u>yes</u>
Balance Verification?:	<u>DDI water in 1mg/ml formaldehyde</u>
Diluent Used:	

Dilution	
*Diluent:	<u>Nanopure water with 1mg/ml formaldehyde</u>
*Density of diluent (g/ml):	<u>N/A</u> g/ml
a: Parent Specific Activity:	<u>9267.27</u> <del>20,388</del> <sup>11-19-94</sup> pCi/g <u>pCi/ml</u>
b: Amount of Source Transferred:	<u>0.7046</u> g
c: Total amount of Dilution:	<u>250.14</u> g
d: Total Volume of Dilution:	<u>N/A</u> ml
e: Activity of Dilution (a * b / c):	<u>N/A</u> pCi/g
f: Activity of Dilution (a * b / d):	<u>26.10</u> pCi/ml
Dilution Logbook I.D. #:	<u>94-677-18-1</u> ✓
Prepared By: <u>James Wong</u>	Preparation Date: <u>11-19-94</u>
Reviewed By: <u>Joe Hittelman</u>	Review Date: <u>12/16/94</u>
<small>*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.</small>	

0099



0109



#### Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

(1) none	less than		%	of the principal activity
(2)	less than		%	of the principal activity
(3)	less than		%	of the principal activity

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

#### Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than  $\pm 0.4\%$

(The 99.7% confidence limits are given by  $t(sm)$  where  $t$  is obtained from the student  $t$  factor for the degree of freedom ( $n-1$ )).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ( $+\delta - \delta'$ ). These have been estimated not to exceed

$+2.9\%$  or  $-2.9\%$

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error [ $t(sm)$ ] at the 99.7% confidence limits and the worst case estimate of the systematic errors ( $+\delta - \delta'$ )

The overall uncertainty is therefore calculated on the basis of  $+[t(sm) + \delta]$ ,  $-[t(sm) + \delta']$  and is  $+4.3\%$ ,  $-4.3\%$  of the quoted radioactive concentration.

#### Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Tritium decays 100 percent by beta emission. The maximum energy is 18.6 Kev, the average is 5.68 Kev.

#### Chemical Composition of Solution

Carrier content per gram of solution:

100 percent  $H_2O$

Other components:

Barium less than  $0.004$  percent  
Lead less than  $3 \times 10^{-5}$  percent

Preservative:

#### Remarks

Date Certificate Prepared

June 17, 1992

Approval Signature

*George Wilbeck*

0110



U.S. DEPARTMENT OF COMMERCE  
National Institute of Standards & Technology  
Gaithersburg, MD 20899

## REPORT OF TRACEABILITY

U.S. Environmental Protection Agency  
Environmental Monitoring Systems Laboratory  
Las Vegas, Nevada

Radionuclide	Hydrogen-3
Source identification	2606-1, prepared by EMSL
Source description	Liquid in 5-mL flame-sealed glass ampoule
Source mass	Approximately 5.0 grams
Source composition	Hydrogen-3 in water
Reference time	0700 EST June 3, 1992

	<u>NIST DATA</u>	<u>EMSL DATA</u>
Radioactivity concentration	810.5 Bq g <sup>-1</sup>	810.3 Bq g <sup>-1</sup>
Expanded uncertainty	0.64 percent <sup>(1,2)*</sup>	4.3 percent <sup>(3)</sup>
Photon-emitting impurities	None observed <sup>(4)</sup>	None observed
Measuring instrument	4 $\pi\beta$ liquid-scintillation counters calibrated with SRM 4926D	Liquid-scintillation counting
Half life	12.43 $\pm$ 0.05 years <sup>(5)</sup>	
Difference from NIST		-0.05 percent <sup>(6)</sup>

For the Director,

J.M. Robin Hutchinson, Acting Group Leader  
Radioactivity Group  
Physics Laboratory

Gaithersburg, MD 20899  
January 1994

\*Notes on next page

## NOTES

- (1) The uncertainty analysis methodology and nomenclature used for the reported uncertainties are based on uniform NIST guidelines and are compatible with those adopted by the principal international metrology standardization bodies [cf., B.N. Taylor and C.E. Kuyatt, *NIST Technical Note 1129* (1993)].
- (2) The combined standard uncertainty,  $u_c = 0.32$  percent, is the quadratic combination of the standard deviation (or standard deviation of the mean where appropriate), or approximations thereof, for the following component uncertainties:
- |  |              |
|--|--------------|
| a) 11 liquid-scintillation measurements on each of 4 vials | 0.11 percent |
| b) gravimetric   | 0.05 percent |
| c) calibration of SRM 4926D                                | 0.29 percent |
| d) background  | 0.00 percent |
| e) half life   | 0.03 percent |
- The expanded uncertainty,  $U = 0.64$  percent, is obtained by multiplying  $u_c$  by a coverage factor of  $k = 2$  and is assumed to provide an uncertainty interval of at least 95% confidence.
- (3) Overall uncertainty reported by EMSL.
- (4) The limit of detection for photon-emitting impurities is:
- $0.08 \text{ } \gamma \text{ s}^{-1} \text{ g}^{-1}$  for energies between 90 and 2700 keV.
- (5) Unterwiesing, M.P., Coursey, B.M., Schima, F.J., and Mann, W.B., Int. J. Appl. Radiat. Isot., **31**, 611 (1980).
- (6) This result demonstrates the traceability of EMSL to NIST, for this measurement, to within five percent as specified in the appendix, Traceability Studies, of the EPA-NIST interagency agreement of April 1976, as amended.

For further information call Larry Lucas at 301-975-5546 or Jeffrey Cessna at 301-975-5539.

PROJECT

H-3

Notebook No.

0721

Continued From Page

NA

## INITIAL STANDARD DILUTION RECORD

Standard Information:			
Isotope:	H-3	Vendor:	EPA
Activity of Standard Received:	.11 uCi	Vendor I.D. #	2/7/95
Weight of Standard Received (g):	5 g	LAL I.D. #:	AC 5299
Standard Activity (pCi/g):	21.9 nCi/g pCi/g	NIST Traceable?	Yes
Half-life in Years or Days:	12.43 yrs	Certificate #:	2606-1
Reference Date:	0900, 6/3/92	Receiver's Name:	Kevin Free
		Date Received:	1/25/95

Primary Dilution			
Balance Verification?:	Yes		
Diluent Used:	EPA Distilled ASTM Type II Water (Deion Water)		
a: Decay Corrected Standard Activity (pCi/g):	21.9 nCi/g 4.939 pCi/g on 6/3/92		
b: Weight of the Source Transferred (g):	4.939 g		
c: Total diluted weight (g):	49.377 g		
d: Total Diluted Volume (mL):	50.0 mL 49.5 mL		
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	2190 pCi/g		
f: Calculated Density of Solution (g/mL) [c / d]:	0.99777 g/mL		
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	2190 pCi/mL on 6/3/92		
h: Dilution Logbook I.D. #:	C. Poniewoz 950-M-2 CAL-95-0721-1		
Prepared By:	Joe Hutchinson / J. Morales	Preparation Date:	2/7/95
Reviewed By:	Joe Hutchinson	Review Date:	2/7/95
Purity/Cross Check Performed By:		Check Date:	0113

Signed

Date

CP5/8/95

Signed

Date

## SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

### Dilution Source Information

Isotope:

H-3 LEST MS

Parent Barcode Number

AC5299

Vendor or Certificate I.D. # of Parent Standard:

Diluted Source Logbook I.D. #:

95-0721-1

Balance Verification?:

Yes

Diluent Used:

Deion Water

### Dilution

\*Diluent:

Low Bkg Water

\*Density of diluent (g/ml):

1 g/ml

a: Parent Specific Activity:

2190 pCi/g

b: Amount of Source Transferred:

10.0 g

c: Total amount of Dilution:

100 g

d: Total Volume of Dilution:

100 ml

e: Activity of Dilution (a \* b / c):

pCi/g

f: Activity of Dilution (a \* b / d):

219 pCi/ml on 6/23/92

Dilution Logbook I.D. #:

94-0677-70

Prepared By:

Joe H. H. H.

Preparation Date:

6/23/95

Reviewed By:

J. A. M.

Review Date:

6/23/95

\*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

read and Understood by

0114

Signed

Date

Signed

Date





U.S. DEPARTMENT OF COMMERCE  
National Institute of Standards & Technology  
Gaithersburg, MD 20899

## REPORT OF TRACEABILITY

U.S. Environmental Protection Agency  
Environmental Monitoring Systems Laboratory  
Las Vegas, Nevada

Radionuclide	Hydrogen-3
Source identification	2606-1, prepared by EMSL
Source description	Liquid in 5-mL flame-sealed glass ampoule
Source mass	Approximately 5.0 grams
Source composition	Hydrogen-3 in water
Reference time	0700 EST June 3, 1992

	<u>NIST DATA</u>	<u>EMSL DATA</u>
Radioactivity concentration	810.5 Bq g <sup>-1</sup>	810.3 Bq g <sup>-1</sup>
Expanded uncertainty	0.64 percent <sup>(12)*</sup>	4.3 percent <sup>(3)</sup>
Photon-emitting impurities	None observed <sup>(9)</sup>	None observed
Measuring instrument	4 $\pi$ $\beta$ liquid-scintillation counters calibrated with SRM 4926D	Liquid-scintillation counting
Half life	12.43 $\pm$ 0.05 years <sup>(9)</sup>	
Difference from NIST		-0.05 percent <sup>(6)</sup>

For the Director,

J.M. Robin Hutchinson, Acting Group Leader  
Radioactivity Group  
Physics Laboratory

Gaithersburg, MD 20899  
January 1994

\*Notes on next page

0116



## INITIAL STANDARD DILUTION RECORD

Standard Information:	
Isotope:	H-3
Activity of Standard Received:	.11 uCi
Weight of Standard Received (g):	5 g
Standard Activity (pCi/g):	21.9 nCi/g
Half-life in Years or Days:	12.43 yrs
Reference Date:	0400, 6/3/92
Vendor:	EPA
Vendor I.D. #	2/7/95
LAL I.D. #:	AC5299
NIST Traceable?	Yes
Certificate #:	2646-1
Receiver's Name:	Karin Free
Date Received:	1/25/95

Primary Dilution	
Balance Verification?:	Yes
Diluent Used:	EPA Distilled ASTM Type II Water (Deionized Water)
a: Decay Corrected Standard Activity (pCi/g):	21.9 nCi/g on 6/3/92
b: Weight of the Source Transferred (g):	4.939 g
c: Total diluted weight (g):	49.377 g
d: Total Diluted Volume (mL):	50.49.5 mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	2190 pCi/g
f: Calculated Density of Solution (g/mL) [c / d]:	0.99777 g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	2190 pCi/mL on 6/2/92
h. Dilution Logbook I.D. #:	C. P. P. 95-0721-1
Prepared By:	J. C. P. / J. Morales
Preparation Date:	2/7/95
Reviewed By:	Joe Hutchinson
Review Date:	2/7/95
Purity/Cross Check Performed By:	
Check Date:	0117

Signed

Date

CP5/8/95

Signed

Date

PROJECT

H-3 LCS

Continued From Page \_\_\_\_\_

## SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

### Dilution Source Information

Isotope: H-3 LCS

Parent Barcode Number: AC 5299

Vendor or Certificate I.D. # of Parent Standard: 2606-1

Diluted Source Logbook I.D. #: LAH-95-721-1

Balance Verification?: Yes

Diluent Used: Deionized Water

### Dilution

\*Diluent: Deep Well Water

\*Density of diluent (g/ml): 0.9977 g/ml

a: Parent Specific Activity: 2190 pCi/g ml

b: Amount of Source Transferred: 5.0 ml

c: Total amount of Dilution: 3995 ml  
4000 ml 11/1/95

d: Total Volume of Dilution: 4000 ml

e: Activity of Dilution (a \* b / c): 2.74 pCi/ml on 6/3/92

f: Activity of Dilution (a \* b / d): 2.74 pCi/ml on 6/3/92

Dilution Logbook I.D. #: 95-721-16-1

Prepared By: Joe HutchinsonPreparation Date: 11/1/95Reviewed By: James WoneReview Date: 1-2-96

\*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Read and Understood by

0118

Signed

Date

Signed

Date